



Authentic Data for Young People
Activities from QuarkNet and SDSS
Masterclasses – Investigations – Research

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QuarkNet

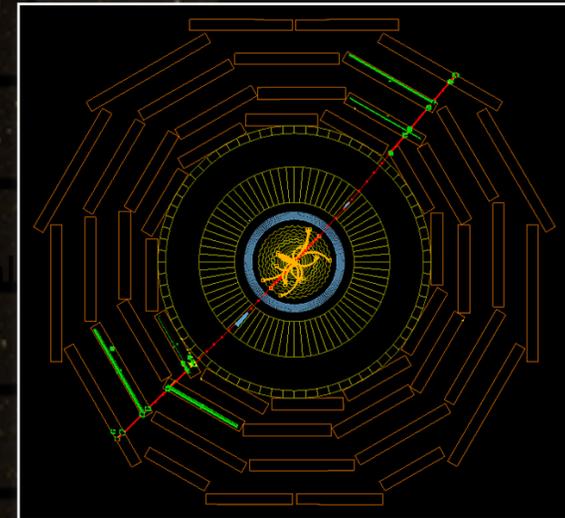
- a particle physics education *collaboration* embedded in the research community at 53 universities and labs across the country with
- a *national infrastructure* that facilitates participation of individual physicists
- a *long-term professional development* program for high school physics teachers and
- a *workforce development* program for their students



Hands-on Analysis with Your Data and You



Data Measurement Exercise



Masterclasses



Videoconference



Facility Tour

Tips for Effective Masterclasses

Get Real – Engage – Tell Your Stories

- 👁️ Share useful examples; show relationships to everyday life.
- 👁️ Bring students into your environment.
 - 👁️ Tour; visit research areas.
- 👁️ Give presentations; answer questions at students' level.
 - 👁️ Focused, short, engaging
 - 👁️ Talk about your experiences.
- 👁️ Some preparation required school helps.

Student Guided Investigations



Cosmic Ray e-Lab

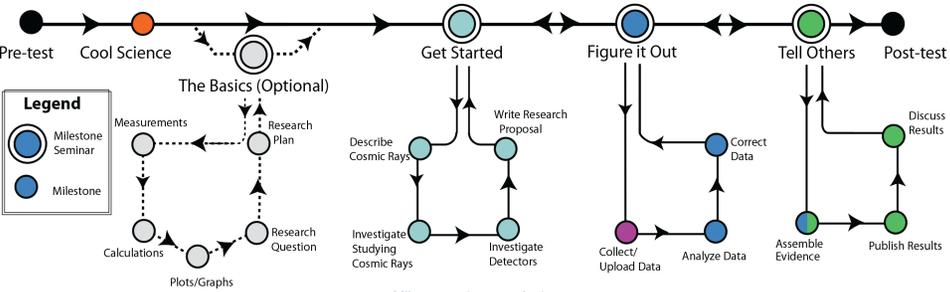
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Project Map
Library
Data
Posters
Site Map
Assessment

Text Version
Cool Science
About Us

Home: Join a national collaboration of high school students to study cosmic rays.

Project Map: To navigate the Cosmic Ray e-Lab, follow the path; complete the milestones. Hover over each hot spot to preview; click to open. Along the main line are milestone seminars, opportunities to check how your work is going. Project milestones are on the four branch lines.



Milestones (text version)

Your team may use the milestones above, or your teacher may have other plans. Make sure you know how to record your progress, keep your teacher apprised of your work and publish your results.

Online e-Labs from I2U2



Cosmic Ray e-Lab

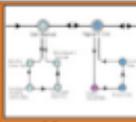
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Home
Library
Data
Posters
Site Map
Assessment

Site Index
Explore!

Explore! Click on hotspots in this site map.

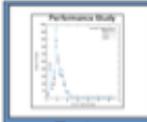
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Home



Library



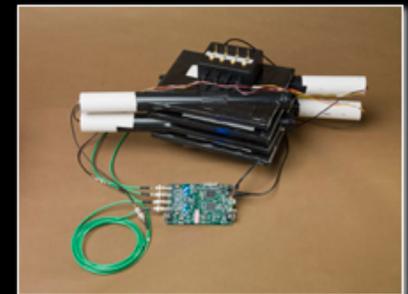
Data



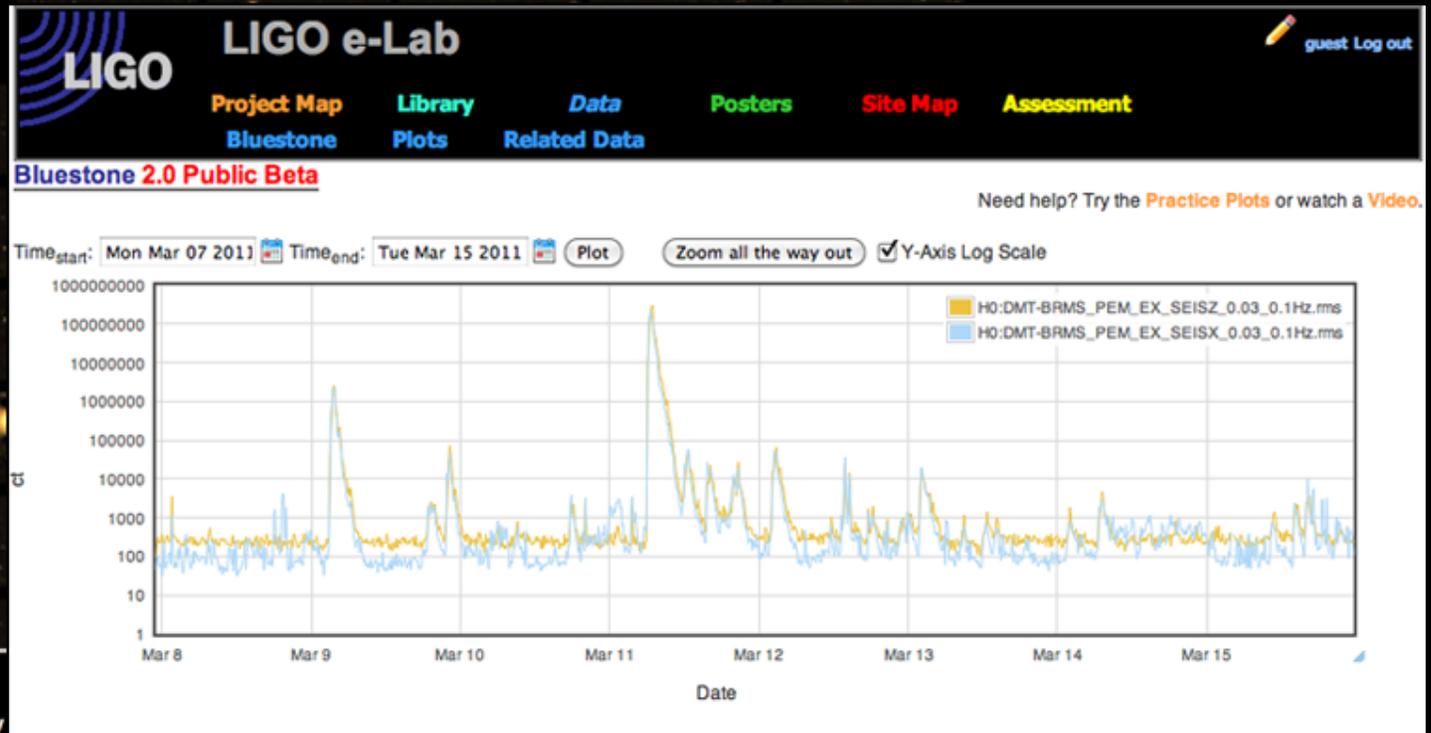
Posters



Assessment



Online Investigations with e-Labs

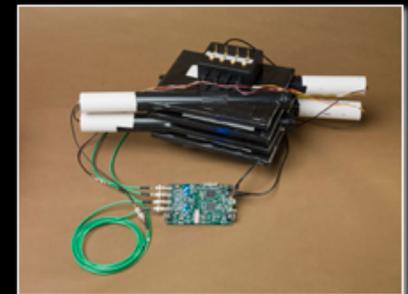
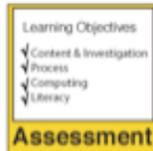
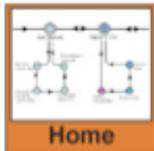


Cosmic Ray e-Lab
Home Library

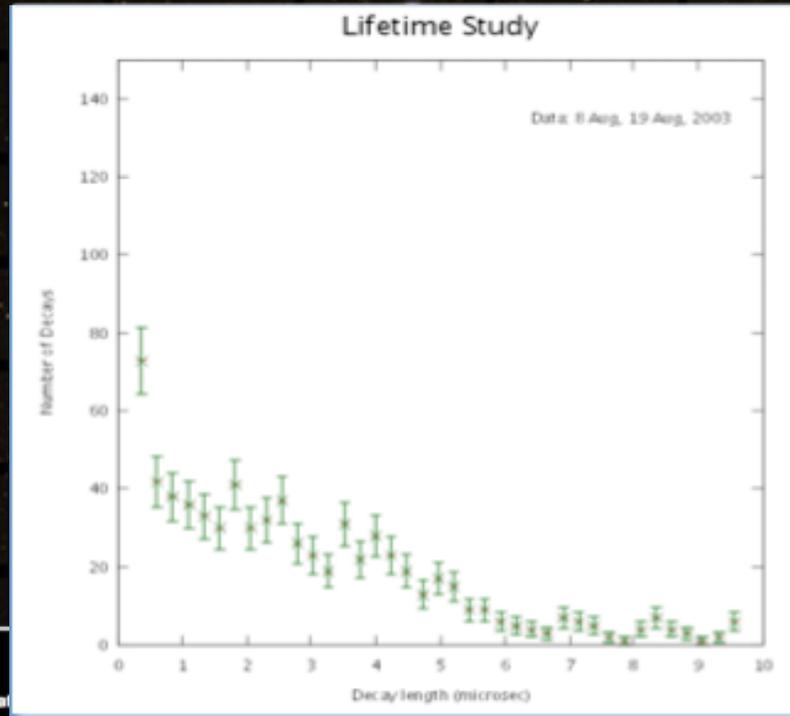
Site index Explore!

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Online Investigations with e-Labs



Cosmic Ray e-Lab

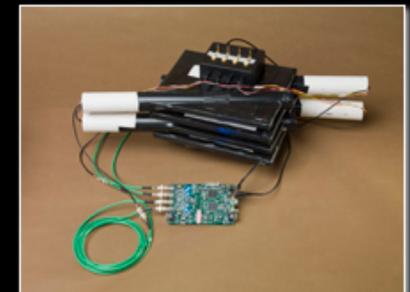
Home Library Data

Site Index Explore!

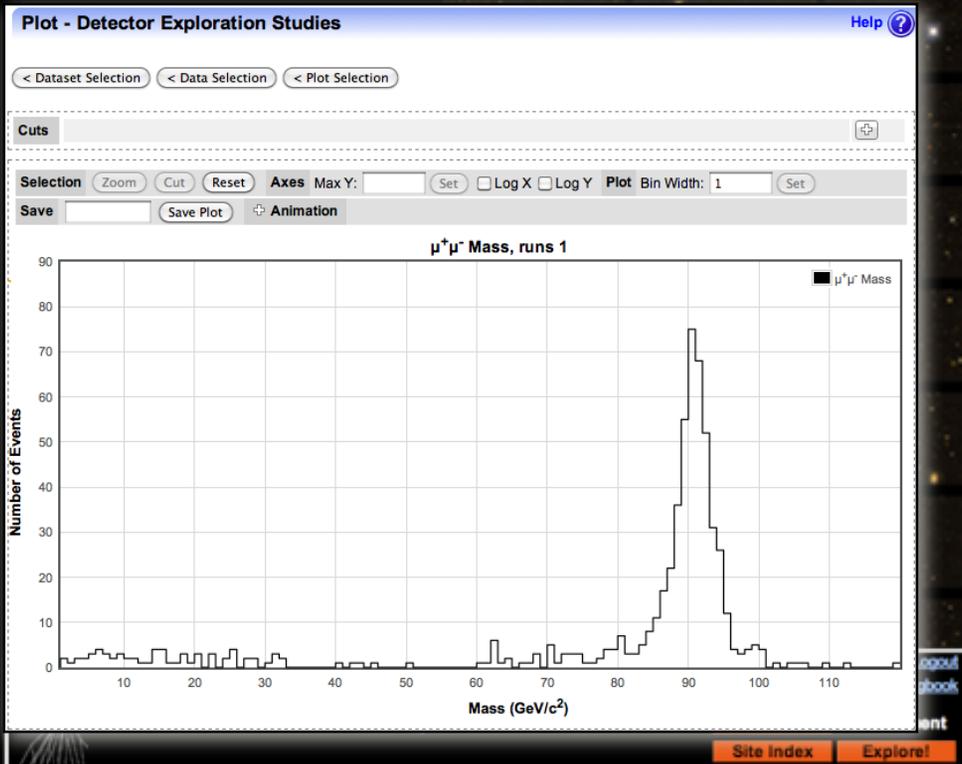
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 Home	 Library	 Data	 Posters	 Assessment
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Online Investigations with e-Labs

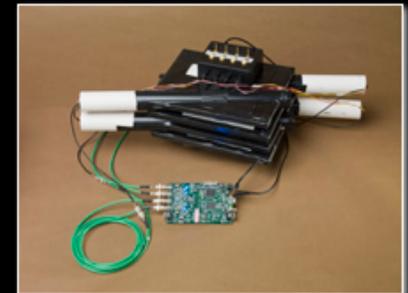


Can I make a text box

Explore! Click on hotspots in this site map.

You can always return to this page by clicking "Explore!" on the Site Index submenu.

 Home	 Library	 Data	 Posters	 Assessment
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Explore an Event

/jpsl/jpsl-jan25_R000140124_T00000020.lg:Events/Run_140124/Event_910214790

The screenshot displays the iSpy Online interface. On the left is a sidebar with a tree view of event data, including categories like HCAL Forward, Tracking, ECAL, HCAL, Muon, and Particle Flow. The main area shows a 3D visualization of particle tracks in yellow, with a red arrow pointing to a specific track. An 'Energy Range Selector' dialog box is open, showing a histogram and the following energy range settings:

Energy Range Selector
Energy range for Barrel Rec. Hits
Low cut: 0.08 GeV (3%)
High cut: 2.23 GeV (100%)

At the bottom left, there are controls for rotating and panning the 3D view:

- rotate
- Ctrl + → pan x / y
- Shift + → pan z

iSpy Online – Tom McCauley

Tips for Effective e-Lab Workshops

Get Real - Engage – Time to Reflect

A two- to three-day teacher workshop is essential for effective classroom implementation.

- 👁️ Let them experience the e-Lab as their students will.
- 👁️ Correlate data to the real detectors.
- 👁️ Provide engaging presentations.
 - 👁️ Background material
- 👁️ Answer questions at their level of understanding.
- 👁️ Provide time for teachers to talk about teaching strategies.

Research Experiences

QuarkNet Research Team

4 students

1 teacher

6 weeks

Engaged in all aspects of research



Tips for Effective Research Programs

Students become part of your research team:

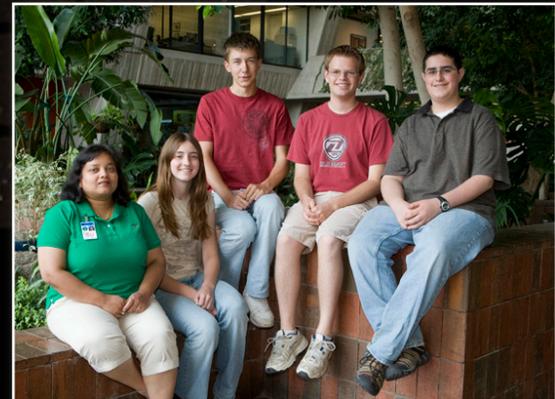
- They experience all aspects of the scientific process.
 - Troubleshooting
 - Calibrating equipment
 - Use of journals or logbooks
 - Why data are analyzed in a particular way
 - Importance of communicating ideas & results
 -
- They report findings.
 - Presentations
 - Posters
 - Abstracts & papers
- They work at least four weeks.

What Students Gain

A broader frame of reference for science:

How scientists make discoveries

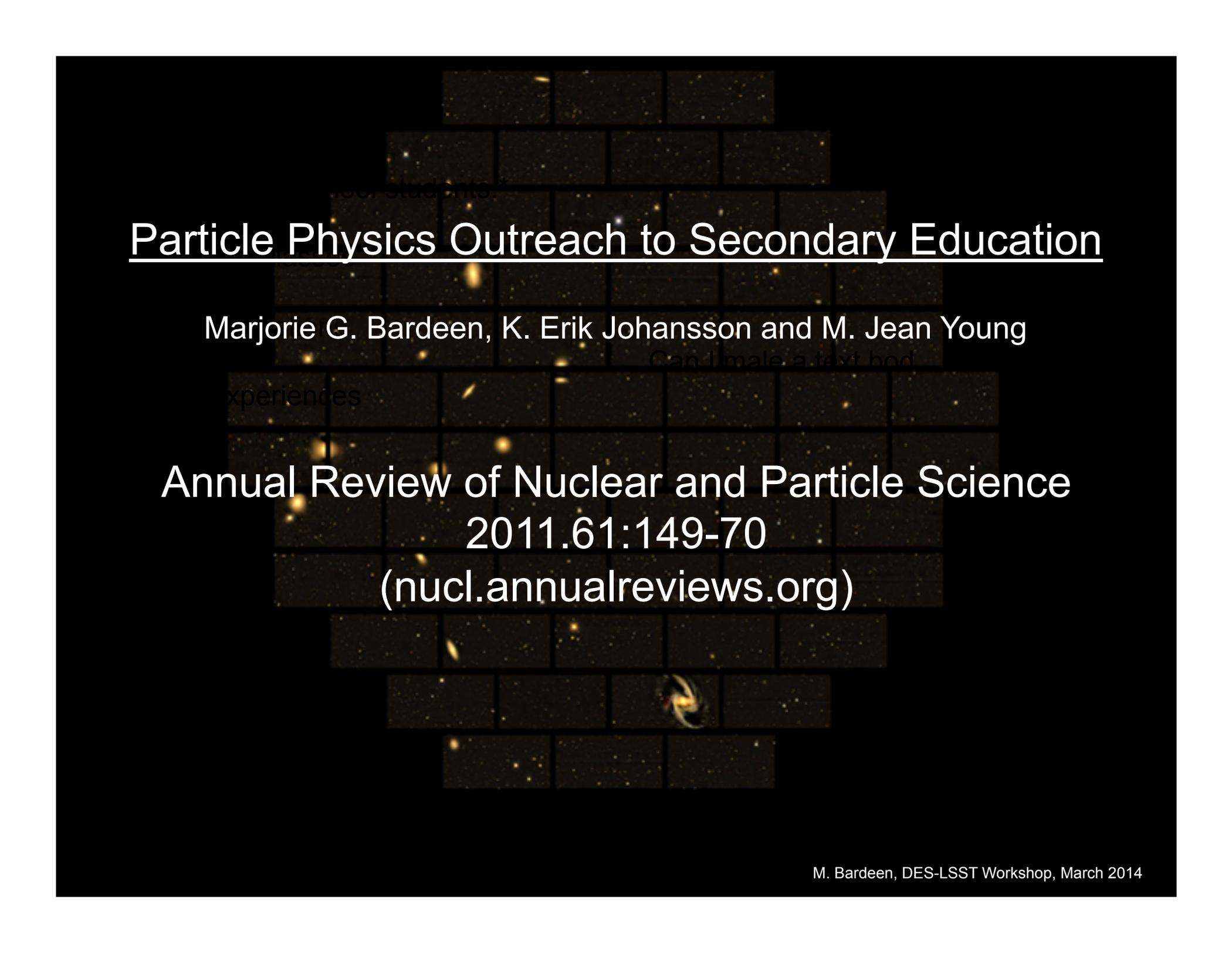
How they talk about their work



How We Know: Data from QuarkNet

Pre- Post-Tests
Teacher & Student Surveys
Scientific Poster Review
Concept Maps





Particle Physics Outreach to Secondary Education

Marjorie G. Bardeen, K. Erik Johansson and M. Jean Young

Annual Review of Nuclear and Particle Science
2011.61:149-70
(nucl.annualreviews.org)

Activities from SDSS

SkyServer

An interface to cataloged SDSS data

Simple to get started; direct access

Download catalog data in comma-separated-variable format.

Originally conceived for students

Became the portal to SDSS data for everyone.

Various activities for classrooms promote "authentic research" and "authentic data."

Over 495 million web hits

Over 74 million SQL queries

through December 31, 2008 (i.e., the end of the SDSS-II)

Activities from SDSS

Galaxy Zoo and Other Web Tools

Citizen scientists classify galaxy images morphologically, extending what can be done by machine.

More than a million participants

An example of what is possible in terms of public engagement in science, e.g., spawning Zooniverse - <https://www.zooniverse.org/>

Developed by a team of collaborators from the United Kingdom and the United States.

SDSS data used in Google Sky and WorldWide Telescope

Activities from SDSS

Other SDSS Outreach

Planetariums, science museums and centers

Educator workshops and professional development

Direct outreach to K-12 students

Research projects for undergraduate students

Except for the SkyServer, SDSS outreach was driven by interested individuals at the collaborating institutions. It was monitored but not directed by the project.

EPO Discussion Session

This workshop is exploring scientific synergies
between the two surveys.

We will explore synergistic EPO strategies too.

Thursday
Racetrack, 7th Floor Crossover

“The U.S. particle physics community recognizes the critical importance of
consistent and coherent communication, education and outreach .”

CSS final report